In preferred embodiments of the exposure shutter, the selection of (i) shutter blade thickness and (ii) number of shutter blades should minimize the attenuation of the intensity of the radiation that passes through the aperture of theshutter frame in the open position. In addition, the exposure device should be in the fully closed position when the **[shutter blades have]** **frame has** been rotated between 1 degree to 45 degrees and preferably between 5 degrees and 15 degrees. [along an axis that is parallel to the plane of the shutter frame aperture] This angle is determined by the width of the **shutter** blades and the distance between them.

The exposure device can be readily scaled to accommodate energy beams having different size footprints. The major design limitations are the speed and shutter actuator torque requirements. The energy beam can comprise radiation having any wavelength, for example, of from 0.1 nm to 1 mm. The energy beams can be generated from any source including, for example, lasers, discharge sources, and synchrotrons. Appropriate lens and mirrors can be employed to generate substantially collimated beams for photolithography applications. It is expected that the exposure device can shutter energy beams that have cross sectional areas of from 5 cm^2 to 30,000 cm^2 or more. Typically for EUV photolithography applications, the radiation will have a footprint or cross sectional areas of from 5,000 cm^2 to 10,000 cm^2. The exposure device is expected to operate in vacuum systems having a pressure that typically ranges from 0.1 torr to 10' torr, or less.

Figures 3A and 3B illustrate operations of shutter blades 26. As shown in Figure 3A, in the open position **the frame is positioned such that** the shutter blades 26 are oriented parallel to the light path so that only a small amount of attenuation occurs. In the closed position, the frame is rotated just enough so that adjacent shutter blades overlap and the light is completely blocked as shown in Figure 3B. As is apparent, since the energy beams travel along the width of the shutter blades, the closer adjacent blades are positioned, the shorter will be the distance of rotation of the frame needed to fully shutter the energy beam. However, the amount attenuation of the radiation when the shutter is in the open position also increases with the number of shutter blades used.

The rotary solenoid is used to move the shutter frame from the open closed position in a short amount of time. The solenoid provides the required high torque output through a short distance. Typically, the larger the solenoid the faster the speed of rotation. Typically the drive means will move the frame from the open position to the closed position or from the closed position to th open position in a